the quartzo-dolomitic series the amount of metamorphism, though the materials are not favourable for its production, is considerable; and the rock has a general resemblance to some of the impure calcareous bands which are incorporated with true schists

in the Alps.

Further, although our knowledge does not at present enable us to speak dogmatically on this point, the weight of evidence is, in my opinion, strongly against the probability of the Newer Gneiss series being altered Silurian rock. I would even go so far as to say that it is such as to throw the *onus probandi* on those who assert its (comparatively) modern date. For five or six years I have been working-I trust without prejudice-at the question of the age of metamorphic rocks, during which time I have visited typical districts in Cornwall, Wales, Scotland, and the Alps; and in every case have been driven to the same conclusion, namely, that wherever extensive regional metamorphism exists, the antiquity of the rocks is very great, so that they are probably anterior to the Cambrian period. I fully expect that when the Durness region is closely scrutinised, it will be found that this fossiliferous limestone is faulted down against the metamorphic series, exactly (for instance) as the so-called Devonian rocks of the Lizard are faulted against the "hornblende schists" of that district, and are a remnant, thus preserved, of a more modern and wide-spread series. Any geologist who would settle this point for us would be entitled to our gratitude, but to do it will require no ordinary conjunction of qualifications; for he must be a practised microscopist, a skilled worker in the field, and a man who cares for truth more than for the traditions of an office, or even his own preconceived opinions.

23, Denning Road, Hampstead

T. G. BONNEY

WITH regard to Mr. Hudleston's letter on the above subject, published in NATURE (vol. xxv. p. 582), I am glad to say that I am still alive, and able to give a part, at least, of the desired evidence for connecting the Durness limestone with the rocks of Assynt and Erribol.

In the year 1858 I accompanied Sir Roderick Murchison, while on a geological tour in Sutherland. During our stay at Inchnadamff, one of our excursions led us together up the River Traligill. Opposite the place where the springs issue from the miniature limestone caverns, about two miles above the bridge, I espied the fossils in dispute - "orthoceratites" - partially weathered out of the dolomitic limestone from which the stream issues. So overjoyed was I, that I called Sir Roderick to my side by shouting "Eureka," as I was a little in advance of him, pointed out the fossils in situ, and after hammering them out of their bed, handed them to him. The circumstances of the achievement are indelibly impressed on my memory. As I only saw these fossils in the field, I am not able to tell to what species they belonged; but there can be no doubt of their nature, as in my attempt to hammer them out of the rock, one of them was broken in such a manner as to expose the septa and the siphuncle.

On a subsequent visit which I made to Sutherland, I had the good fortune to see the specimen of Orthoceras (Cameroceras) Brongniartii alluded to by Mr. Hudleston as "having been found in the upper quartz-rock of Erribol." It was in the possession of the finder, the late Mr. Clark, of Erribol House, who kindly allowed me to examine it. Mr. Clark accompanied me to the place, and pointed out the exact spot where he got the specimen-a little to the north-east of Erribol House. CHAS. W. PEACH

30, Haddington Place, Edinburgh, April 24

The Magnetic Storms

THE magnetographs at the Kew Observatory were a little disturbed from about 11 p.m. of the 13th inst. to 7 p.m. of the 14th inst. During the 15th they were quiet, and remained so up to 11.45 p.m. of the 16th, when the disturbance began by an increase of the declination, an augmentation of the horizontal force, and a diminution of the vertical force. The movements of the declinometer became gradually more rapid after 2 a.m. on the 17th, whilst its oscillations extended farther and farther from its normal position principally in the direction of increased westerly declination.

From 4.30 to 9 a.m. the horizontal force had diminished so much that the trace frequently passed off the paper and the register was lost for a while. At this time the force must have been more than 05 mm.mgrs. below its average value.

The minimum of vertical force occurred at 5.55 a.m., when it was about 0.07 units too low.

From 10 a.m. to noon of the 17th the motion of the declinometer was small, whilst the components of magnetic force were rapidly increasing in intensity, until at 0.15 p.m. both traces left the photographic sheet in the direction of augmented force; at this time the declination needle merely oscillated rapidly about its ordinary position.

The horizontal force instrument recommenced to record about 2 p.m., and the vertical force about 2.45 p.m.; afterwards the movements of all three gradually diminished, and at about 8 p.m. the disturbance had died out.

During the 18th and 19th the magnets remained unaffected, but at 3.45 a.m. of the 20th a second disturbance set in, commencing with a rapid increase of declination, the first swing of the magnet carrying it nearly a degree to the westward, whence it returned at 4.30 a.m. Its mean position was reached at 6 a.m., and then its oscillations became very rapid, and continued so until 2 p.m, after which hour they became less; but the effect of one disturbance lasted until 7.30 a.m. of the 21st.

Both forces were also simultaneously disturbed, but their movements were much more limited than on Monday, the extremes being in the horizontal '04 mm.mgrs., and in the vertical 0'3 mm.mgrs. only.

G. M. WHIPPLE 0'3 mm.mgrs. only. Kew Observatory, April 24

Colour Perception

WHILE working at dry-plate photography in a ruby light, I noticed that when any light-coloured article, such as the hand, was rapidly moved, it appeared of a brilliant greenish-blue, in which blue predominated, while, when slowly moved, it appeared of the same colour as the other objects in the room. Seeking for an explanation, led me to recognise a new fact about reason of the hand appearing blue when in rapid motion was because the continual use of the red light had fatigued that part of the retina responsive to it, and the light reflected from the hand impinging for a very short time on the retina, was not strong enough to excite the sensation of red, but was quite sufficient for blue, the nerves responding to this colour having been rendered acutely sensitive by complete rest. To test this hypothesis, I obtained some dark blue glass and applied it to the window of the dark room, removing the red. On repeating the experiment, the eye with its blue sense exhausted, saw rapidlymoving objects reddish. Now from this it is clear that it takes a longer time to cause a sensation in an exhausted than in a fresh organ. It also gives a direct proof of Helmholtz's suggestion, "that actual coloured light does not produce sensations of absolutely pure colour; that red, for instance, even when completely freed from all admixture of white light, still does not excite those nervous fibres alone which are sensitive to impressions of red, but also to a very slight degree those which are sensitive to green, and perhaps to a still smaller extent those which are sensitive to violet rays" ("Popular Scientific Lectures," first series, p. 223). These observations have led me to an explanation of a very curious phenomenon brought under my notice by my friend, Mr. Napier Smith. When discs of paper on which black spaces have been marked, so that on rotation the eye receives impressions of black and white too rapidly to notice the pattern, but too slowly to combine into a neutral gray, the rotating card appears to be distinctly coloured, especially when it is looked at without keen attention, or as we may say passively. All colours may be seen, but red and blue were the most distinct to me. I at first thought that the colour might arise out of the paper and ink, the former being perhaps tinted with blue to whiten it in manufacture, and the latter probably a dark brown; but on looking several times at the rotating discs, and acquiring the power of looking passively the intensity of the colours could not be so accounted for. The true explanation is found, I believe, in the fact that the different colour organs require longer or shorter periods of excitation before recogniting to the circulus and that these which require before responding to the stimulus, and that those which require the longest periods also retain the sensation longest. only made very rough trials, but they point to the fact that the eye responds quickest to red, so that the most rapid alternation will appear reddish, a little slower green will come in, and cause some indescribable colours, such as are seen in the polariscope, and lastly, when green and red are about equal, and producing white, blue will be seen. The blue is best seen with a slow

rotation, and a large amount of black, because the red and green impressions have time to die out, and the blue (the most persistent) remains alone, showing like a fine fluorescent layer overlying the disc. I have not at present the time, or I would attempt to find out the excitation-periods for the different colours by this method, and I believe that a finer mode of applying it might determine the real number of colour-sensations, and allow of a decision being arrived at between the theories of Young and Hering.

J. B. HANNAY

Dispersal of Freshwater Bivalves

In the late Mr. Darwin's interesting contribution upon this subject (NATURE, vol. xxv. p. 529), mention is made of the fact that the newts in Mr. Norgate's aquarium "frequently have one foot caught by a small freshwater bivalve (Cyclas cornea?)." It is, perhaps, worth calling your readers' attention to a passage which occurs in Mr. Knapp's "Journal of a Naturalist" (2nd ed., p. 316), published in 1829, wherein, speaking of the newt, he says: "I have seen the boys in the spring of the year draw it up by their fishing lines, a very extraordinary figure, having a small shell-fish (Tellina cornea) attached to one or all of its feet; the toes of the newt having been accidentally introduced into the gaping shell, in its progress on the mud at the bottom of the pool, or decidedly put in for the purpose of seizure, when the animal inhabitant closed the valves and entrapped the toes. . ."

This record, coupled with Mr. Norgate's statement in the article referred to, that "newts migrate at night from pond to pond, and can cross over obstacles which would be thought to be considerable," seems to point to the fact that the dispersal of bivalves by this means is more general than might at first be supposed.

Frank J. Rowbotham

The Horse in Motion

IN NATURE, vol. xxv. p. 591, you notice the publication of a work entitled "The Horse in Motion," by Dr. Stillman, and remark: "the following extract from Mr. Stanford's preface shows the exact part taken by each of those concerned in the investigations." Will you permit me to say, if the subsequently quoted "extract" from Mr. Stanford's preface is suffered to pass uncontradicted, it will do me a great injustice and irreparable injury. At the suggestion of a gentleman, now residing in San Francisco, Mr. Stanford asked me if it was possible to photograph a favourite horse of his at full speed. I invented the means employed, submitted the result to Mr. Stanford, and accomplished the work for his private gratification, without remuneration. I subsequently suggested, invented, and patented the more elaborate system of investigation, Mr. Stanford paying the actual necessary disbursements, exclusive of the value of my time, or my personal expenses. I patented the apparatus and copyrighted the resulting photographs for my own exclusive benefit. Upon the completion of the work Mr. Stanford presented me with the apparatus. Never having asked or received any payment for the photographs, other than as mentioned, I accepted this as a voluntary gift; the apparatus under my patents being worthless for use to any one but myself. These are the facts; and on the bases of these I am preparing to assert my rights. 449, Strand, W.C., April 26 I. MUYBRIDGE

DAILY WEATHER CHARTS IN THE NORTH ATLANTIC

WE append to this notice one of the most important statements hitherto issued from the Meteorological Office, from which it will be seen that the Meteorological Council have resolved to undertake the preparation of Daily Weather Charts of the North Atlantic for the thirteen months commencing next August. The scheme will, without doubt, call forth a co-operation equally hearty on the part of the owners, captains, and officers of sailing vessels and steamers which cross the Atlantic.

The figures of the wreck returns for the four years ending with June. 1880, show a striking diminution year by year, resulting as regards the gross totals in a steady reduction from 1805 in 1876-77 to 891 in 1879-80, or less than half the losses and casualties to shipping attributable to causes connected with the weather round the British coasts. No small

part of this gratifying result may fairly be claimed as due to a gradual improvement in weather-forecasting and to a more intelligent attention now generally given to observational and instrumental indications of coming storms by those who man our fishing boats and coasting vessels. That much, however, yet remains to be done in some quarters by disseminating even the merest elementary notions of the subject was shown by the lamentable loss of life on October 14, 1881, on the morning of which day whole fleets of boats left the harbours and stood out to sea in the face of a barometer which had during the previous twelve hours gone down more than an inch.

The object aimed at is better and fuller information than is yet possessed as to the origin, development, and progressive movement of the storms which occur over the This information will not only immediately benefit seamen, but also promote the science of meteorology, and thus tend directly to the improvement of the weather forecasts and storm warnings issued to the British coasts by rendering easier and more certain the interpretation of the first indications of approaching changes noted at the western stations in Ireland and Scotland. The commencement of the observations in August next has been happily chosen, it being then that observations also begin at the international Arctic sta-tions, which have been planted by different nationalities in Kamschatka, Siberia, Nova Zembla, northern Scandinavia, Greenland, and Arctic North America. There will thus be brought to bear on the examination of the Atlantic storms a fulness of information gathered from these floating and stationary observatories which will so largely extend the field of observation chiefly on what we may call the weather-side of Europe, not hitherto attainable, which cannot but be productive of solid advantages to our seafaring population, and to all whose material interests may be benefited by a knowledge beforehand of weather changes.

The Meteorological Council, however, act wisely in warning against being over-sanguine as to the importance of the results to be obtained by the inquiry they are about to undertake. No decidedly great step is likely to be taken in the improvement of weather forecasting, as regards time and precision, until either of two things be done, namely, till either a cable be laid to Newfoundland, viâ Faro, Iceland, and Greenland, or till science has taught us to moor a ship 700 or 800 miles out in the Atlantic, as a floating meteorological observatory, con-

nected by cable with the west of Ireland.

The observations of the temperature of the surfacewater of the Atlantic it is proposed to make from the equator northwards, is one of the most important features of the investigation. By these observations, continued widely and uninterruptedly over a space of thirteen months, the great practical question of the bearing of the temperature of the surface-water of the Atlantic, particularly between lat. 30° and 50°, on the character of coming seasons, can be investigated, and different theories on the subject be put to the proof. To take an example -it has been inquired (NATURE, vol. xxi. p. 142) whether, when the temperature of the Atlantic to the south-west of the British Islands, is decidedly above the normal temperature of the season, it does not follow, owing to the larger evaporation and other resulting effects, that Atlantic storms take a more southerly course than usual in their passage across Europe. If the storms of any particular winter pursue an easterly course to southwards, of the British Islands, that winter will, like the winter of 1870-71, be a severe one; but if, on the other hand, these storms pursue a course to the northward, the winter will partake more or less of the mildness of the winter we have just passed through. Since the character of the season thus depends on the line followed by the atmospheric disturbances which occur, it results that if the track of the storms be dependent on the amount of evaporation from